original article

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European cancer mortality predictions for the year 2011

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Background: Mortality figures become available after some years.
Materials and methods: Using the World Health Organization mortality and population data, we estimated numbers of deaths in 2011 from all cancers and selected sites for the European Union (EU) and six major countries, by fitting a joinpoint model to 5-year age-specific numbers of deaths. Age-standardized rates were computed using EUROSTAT population estimates.
Results: The predicted number of cancer deaths in the EU in 2011 was 1 281 436, with standardized rates of 143/100 000 men and 85/100 000 women. Poland had the highest rates, with smaller falls over recent periods. Declines in mortality for major sites including stomach, colorectum, breast, uterus, prostate and leukemias, plus male lung cancer, will continue until 2011, and a trend reversal or a leveling off is predicted where upward trends were previously observed. Female lung cancer rates are increasing in all major EU countries except the UK, where it is the first cause of cancer death, as now in Poland. The increasing pancreatic cancer trends in women observed up to 2004 have likely leveled off.
Conclusions: Despite falls in rates, absolute numbers of cancer deaths are stable in Europe. The gap between Western and former nonmarket economy countries will likely persist.
Key words: cancer, Europe, mortality, projections, time trends

introduction

Estimates of current cancer mortality, in terms of absolute numbers and of rates, are essential for planning resource allocation and designing and evaluating cancer prevention and management strategies. However, mortality figures generally only become available after a few years [1]. A reliable system to estimate current mortality statistics is of considerable interest and has been developed for USA data [2, 3]. The scope of this work is to present estimates of mortality for all cancers and for selected major cancer sites in the year 2011 in the whole European Union (EU) and in its six more populated countries, using actual mortality data up to the most recent available year, which is between 2005 and 2007 for most EU countries.

materials and methods

We obtained from the World Health Organization (WHO) database (WHO Statistical Information System) [4], official death certification data from stomach, intestines (colon and rectum), pancreas, lung, breast, uterus (cervix and corpus), prostate, leukemias and total cancer for the EU in the period 1970–2007 and up to the most recent available year for six EU countries: France (2007), Germany (2006), Italy (2007), Poland (2008), Spain (2005) and the UK (2007). The EU was defined as the 27 member states as of January 2007. Data for Cyprus were not available. For the calculation of the EU rates, when data were not available for a country, the nearest available data were replicated (see supplemental Appendix 1, available at *Annals of Oncology* online).

No interpolation was made for individual countries for missing data except for the construction of the EU rates.

During the calendar period considered, three different revisions of the International Classification of Diseases (ICD) were used. Cancer deaths were recoded according to the 10th revision of the ICD [5]: stomach cancer (C16), intestinal (mainly colon and rectum) cancer (C17–C21, C26), pancreas (C25), lung (C34), breast (C50), uterus (cervix and corpus; C53–C55, C58), prostate (C61), leukemias (C91–C95) and total cancers (C00–D48).

Estimates of the resident population were obtained from the same WHO database. Population projection estimates for the year 2011 were obtained from EUROSTAT [6].

We computed age-specific rates and numbers of deaths for each 5-year age group (from 0–4 to 80+ years) and calendar year. Age-standardized rates, per 100 000 men and women, at all ages, were computed using the direct method, on the basis of the world standard population [7].

Joinpoint models were fitted to the logarithm of each 5-year age-specific number of deaths, assuming a Poisson distribution, in order to identify the most recent trend segment. The joinpoint model was set to a maximum of five identifiable segments (four joinpoints) and to have at least five data points for the last segment [8].

A linear regression was carried out on mortality data from each age group over the time period identified by the joinpoint model, in order to compute the predicted age-specific numbers of deaths, the corresponding 95% confidence intervals (CIs) and prediction intervals (PIs; i.e. the CIs for the

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prediction of a single future value, calculated using a standard error accounting for the variability of the new observation) [9]. Using the projected EUROSTAT population data, we computed predicted age-specific and age-standardized death rates (world population) with 95% CI and PI.

results

The prediction method was tested by estimating the last calendar year available using data from up to 4 years earlier (supplemental Appendix 1, supplemental Tables A1–A7, available at *Annals of Oncology* online). Real values for total numbers of deaths and standardized rates were within the modeled 95% PI with very few exceptions; in the EU (2007 data), falls in death rates for gastric and intestinal cancer in women were overestimated, as for stomach cancer in both sexes in the UK.

Tables 1–7 show the total numbers of predicted deaths and standardized death rates in 2011 for the studied neoplasms with 95% PI and CI, in the whole EU and the six largest EU countries.

Figure 1 shows total cancer death standardized rate trends, for European men and women, for the central years of quinquennia (1982–2007) and the predicted rates in 2011. Figures 2 and 3 show standardized trends in death rates for the examined cancer sites in men and women, respectively.

The predicted total number of cancer deaths in the EU in 2011 is 1 281 436 (721 252 men and 560 184 women), as compared with 1 256 001 (703 872 men and 552 129 women), in 2007. The estimated standardized total cancer death rates in 2011 are 142.8/100 000 men and 85.3/100 000 women, compared with 153.8/100 000 men and 90.7/100 000 women. This would correspond to a 7% fall in men and a 6% one in women. In men, lung cancer accounts for the most deaths (182 080 deaths, 25% of total male cancer deaths) with standardized rate of 37.6/100 000, 9% lower than the rate recorded in 2007. In women, the favorable total cancer trends are mainly driven by falls in breast cancer mortality (the first cause of female cancer deaths, making up for 16% of total cancer mortality with 87 843 deaths and a standardized rate of 15.1/100 000 women), colorectal (73 721 deaths, 9.5/100 000 women) and stomach (21 370 deaths, 2.9/100 000 women) cancers. These downward trends in rates were reflected in all the examined cancer sites except for pancreatic cancer, stable in men (37 587 deaths, 7.8/100 000 men) and recording a slight rise in women (37 120 deaths, 5.3/100 000 women), and female lung cancer, which rose from 12.6/100 000 women in 2007 to 13.1/100 000 (75 688 deaths) in 2011.

Figure 4 shows bar plots of standardized death rates per 100 000 population for the year 2007 and the predicted rates for 2011 with 95% PIs for the EU in men and women for the studied cancer sites.

Figure 5 shows bar plots of standardized death rates per 100 000 population and certified deaths for the year 2007 and the predicted rates and number of deaths for 2011 with 95% PIs for total cancer mortality in the EU in men and women.

The predicted total cancer standardized mortality rate for 2011 showed favorable trends for all the studied countries in both sexes. The highest rates were in Poland for both sexes, falling 5% to 183.7/100 000 in men since 2008 and 1% to 104.4/100 000 in women. Total male cancer rates were also higher than the overall EU ones in Spain (145.5/100 000 men, 7% fall since 2005) and France (151.4/100 000 men, 6% fall since 2007). Germany, Italy and the UK have predicted male total cancer mortality rates lower than the EU ones, with Germany and the UK having the lowest at 125.1 and 126.4 per 100 000 men, displaying 10% and 8% falls since 2006 and 2007, respectively. Conversely, total female cancer mortality rates in the UK are high compared with the EU and the other studied countries (with the exception of Poland), but they fell 8%, with a predicted rate of 95.6/100 000 women in 2011. France, Germany and Italy all had female rates that were lower, but comparable with those in the EU (between 79 and 86 per 100 000 women), while Spain had sensibly lower female rates, falling 8% since 2005 and reaching 65.9/100 000 women.

Stomach cancer mortality rates were again the highest in Poland (11.6/100 000 men and 3.9/100 000 women), with rates being fourfold higher than the lowest seen in UK males (3.1/100 000 men) and threefold those in UK females (1.3/100 000 women).

Poland had the highest intestinal cancer mortality rates (20.7/100 000 men and 10.8/100 000 women). In men, the lowest rates were in France (13.9/100 000 men), while Germany had the lowest female predicted rates (7.9/100 000 women).

Pancreatic cancer mortality rates in males varied between 6.4 and 8.4 per 100 000 men and between 3.7 and 5.8 per 100 000 women. In men, age-standardized rates for this neoplasm remained stable compared with the last recorded data. In women, the trend was approximately stable, with the exception of Spain that recorded a slight fall reaching the lowest female rate of 3.7/100 000 women and France where the rate increased by almost 8% (up to 5.3/100 000 women).

Male lung cancer rates had favorable trends in all the studied countries, with estimated rates varying between 56.7/100 000 in Poland and 28.3/100 000 in the UK. Conversely, in women, rising trends were observed in all countries with the exception of the UK that had the highest at 20.3/100 000 women, over threefold higher than the lowest estimated rate for Spain (6.5/100 000 women).

Estimated female breast cancer rates all resulted in falling trends. The highest rates were in the UK (17.2/100 000 women) and the lowest ones in Spain (11.3/100 000 women).

Estimated mortality rates for cancer of the uterus in Poland were three times higher than the lowest rates projected for Germany, 7.9 and 2.6 per 100 000 women, respectively. The remaining countries and the EU showed values between 3.4 and 4.6/100 000 women. Estimated rates showed favorable changes in all countries.

Prostate cancer estimated mortality rates for 2011 varied between 12.6 and 8.1/100 000 men with the highest being in Poland and the UK while the lowest ones were in Italy. The trend for this cancer was also favorable in all the studied countries.

Predicted mortality rates for leukemias for Poland were higher than the other countries in both men (5.3/100 000) and women (2.9/100 000), while for Spain they were lower (3.6/100 000 men and 1.8/100 000 women). In the remaining countries and the EU, rates varied between 3.9 and 4.6 per 100 000 in men and 2.4 and 2.6 per 100 000 in women. All the estimated rates were lower than those recorded in the last available year.

discussion

Albeit these are short-term predictions and therefore no major unexpected event should affect them, it is still possible that

Table 1. Number of predicted deaths and mortality rate in the EU for the year 2011, with 95% PIs and CIs and comparison data from 2007

Sex	Cancer	Recorded deaths 2007	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2007	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	37 416	34 526	33 883	35 169	34 103	34 949	8.07	6.75	6.62	6.88	6.67	6.83
	Intestine (colon and rectum)	84 480	88 305	87 185	89 426	87 548	89 062	17.66	16.80	16.57	17.04	16.65	16.96
	Pancreas	34 714	37 587	37 150	38 025	37 287	37 887	7.84	7.84	7.74	7.94	7.77	7.91
	Lung	182 132	182 080	179 006	185 153	180 114	184 045	41.31	37.55	36.84	38.26	37.10	38.00
	Prostate	67 959	69 453	68 007	70 899	68 418	70 488	12.00	10.97	10.76	11.18	10.83	11.12
	Leukemias	21 603	22 302	21 724	22 880	21 843	22 760	4.86	4.40	4.24	4.56	4.32	4.49
	All cancers (malignant and benign)	703 872	721 252	712 863	729 640	715 740	726 764	153.75	142.79	141.09	144.50	141.71	143.87
Women	Stomach	24 924	21 370	20 689	22 051	20 919	21 821	3.66	2.87	2.76	2.98	2.81	2.93
	Intestine (colon and rectum)	75 189	73 721	72 856	74 585	73 143	74 299	10.57	9.54	9.40	9.68	9.46	9.62
	Pancreas	34 590	37 120	36 461	37 778	36 635	37 604	5.21	5.27	5.18	5.37	5.20	5.35
	Lung	68 553	75 688	74 502	76 873	74 762	76 614	12.55	13.12	12.87	13.37	12.92	13.32
	Breast	88 655	87 843	86 540	89 146	86 907	88 779	16.41	15.07	14.83	15.30	14.90	15.23
	Uterus (cervix and corpus)	27 268	26 181	25 651	26 710	25 780	26 582	5.17	4.61	4.50	4.72	4.52	4.69
	Leukemias	17 803	18 285	17 871	18 699	18 007	18 563	2.94	2.56	2.43	2.69	2.51	2.62
	All cancers (malignant and benign)	552 199	560 184	555 169	565 200	556 489	563 880	90.72	85.33	84.54	86.13	84.75	85.92

EU, European Union; PI, prediction interval; CI, confidence interval; std., standardized.

Table 2. Number of predicted deaths and mortality rate in France for the year 2011, with 95% PIs and CIs and comparison data from 2007

Sex	Cancer	Recorded deaths 2007	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2007	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	3025	2957	2831	3083	2868	3046	5.10	4.61	4.37	4.85	4.44	4.77
	Intestine (colon and rectum)	9758	9755	9388	10 121	9496	10 014	15.45	13.95	13.35	14.56	13.54	14.37
	Pancreas	4431	4737	4572	4901	4633	4841	7.93	7.83	7.55	8.10	7.66	7.99
	Lung	22 144	23 608	22 942	24 274	23 105	24 111	42.10	41.22	39.81	42.62	40.12	42.32
	Prostate	9033	8859	8435	9284	8549	9170	11.74	10.27	9.68	10.85	9.84	10.70
	Leukemias	3051	3164	2983	3346	3040	3289	5.03	4.61	4.34	4.88	4.45	4.77
	All cancers (malignant and benign)	92 425	95 649	93 631	97 667	94 084	97 214	160.40	151.42	147.47	155.38	148.33	154.52
Women	Stomach	1659	1514	1377	1652	1418	1610	1.78	1.66	1.51	1.81	1.57	1.75
	Intestine (colon and rectum)	8637	8769	8374	9164	8476	9062	8.88	8.39	7.90	8.87	8.01	8.76
	Pancreas	4192	4745	4540	4950	4591	4899	4.92	5.29	5.09	5.49	5.15	5.44
	Lung	6497	7718	7376	8060	7445	7991	10.14	11.66	11.00	12.32	11.12	12.20
	Breast	11 379	11 661	11 280	12 042	11 403	11 918	16.67	16.07	15.48	16.65	15.70	16.43
	Uterus (cervix and corpus)	3115	3143	3015	3271	3055	3231	4.30	4.08	3.86	4.31	3.94	4.23
	Leukemias	2466	2526	2388	2663	2432	2619	2.91	2.52	2.30	2.74	2.41	2.63
	All cancers (malignant and benign)	63 711	66 710	65 498	67 922	65 785	67 635	80.60	79.78	77.87	81.68	78.26	81.30

PI, prediction interval; CI, confidence interval; std., standardized.

Table 3. Number of predicted deaths and mortality rate in Germany for the year 2011, with 95% PIs and CIs and comparison data from 2005

Sex	Cancer	Recorded deaths 2006	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2006	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	5986	5075	4777	5374	4850	5301	7.14	5.26	4.87	5.65	4.96	5.56
	Intestine (colon and rectum)	14 502	14 175	13 596	14 754	13 755	14 595	16.92	14.24	13.56	14.92	13.73	14.75
	Pancreas	6729	7215	6902	7528	6959	7470	8.28	8.07	7.67	8.47	7.74	8.40
	Lung	28 898	28 005	26 848	29 163	27 047	28 963	35.73	31.17	29.62	32.73	29.86	32.48
	Prostate	11 577	11 496	10 964	12 029	11 092	11 900	11.97	10.23	9.75	10.71	9.86	10.60
	Leukemias	3720	3874	3626	4122	3672	4077	4.64	3.89	3.57	4.21	3.66	4.12
	All cancers (malignant and benign)	115 176	116 857	112 514	121 199	113 456	120 258	139.17	125.10	119.71	130.48	120.70	129.50
Women	Stomach	4937	3681	3388	3975	3448	3915	3.83	2.68	2.42	2.94	2.47	2.89
	Intestine (colon and rectum)	14 313	12 101	11 668	12 534	11 777	12 425	10.31	7.92	7.55	8.28	7.64	8.20
	Pancreas	7213	7568	7221	7914	7280	7855	5.76	5.74	5.41	6.07	5.46	6.02
	Lung	11 873	13 585	13 206	13 963	13 289	13 881	12.38	13.67	13.20	14.14	13.30	14.05
	Breast	17 286	17 298	16 525	18 070	16 631	17 964	17.45	16.39	15.37	17.42	15.49	17.30
	Uterus (cervix and corpus)	3889	2894	2624	3163	2678	3109	3.74	2.57	2.21	2.93	2.26	2.88
	Leukemias	3387	3506	3332	3681	3365	3648	2.92	2.60	2.39	2.81	2.47	2.73
	All cancers (malignant and benign)	101 919	98 804	96 457	101 150	96 906	100 702	89.11	82.26	80.03	84.50	80.38	84.14

PI, prediction interval; CI, confidence interval; std., standardized.

Table 4. Number of predicted deaths and mortality rate in Italy for the year 2011, with 95% PIs and CIs and comparison data from 2007

Sex	Cancer	Recorded deaths 2007	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2007	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	6085	5589	5296	5882	5384	5794	9.01	7.31	6.90	7.73	7.07	7.56
	Intestine (colon and rectum)	11 230	11 581	11 320	11 841	11 397	11 765	16.21	15.15	14.74	15.56	14.88	15.42
	Pancreas	4750	5211	5019	5403	5071	5351	7.61	7.82	7.54	8.10	7.63	8.01
	Lung	25 425	24 807	23 838	25 776	24 141	25 473	39.03	33.76	32.23	35.28	32.78	34.73
	Prostate	7501	7857	7334	8380	7447	8267	8.73	8.14	7.67	8.61	7.79	8.49
	Leukemias	3201	3189	3038	3340	3081	3297	5.18	4.43	4.10	4.77	4.24	4.62
	All cancers (malignant and benign)	97 353	99 574	97 491	101 658	98 033	101 116	146.14	135.35	132.40	138.30	133.30	137.41
Women	Stomach	4437	4084	3888	4279	3941	4226	4.40	3.67	3.39	3.95	3.49	3.85
	Intestine (colon and rectum)	10 167	10 240	9927	10 553	10 016	10 465	10.21	9.37	9.02	9.73	9.17	9.58
	Pancreas	5084	5539	5360	5719	5414	5665	5.28	5.29	5.08	5.51	5.17	5.42
	Lung	7509	8313	8078	8549	8139	8487	9.45	9.85	9.58	10.12	9.67	10.03
	Breast	11 916	11 987	11 578	12 396	11 671	12 303	16.18	15.14	14.50	15.78	14.65	15.63
	Uterus (cervix and corpus)	2822	2842	2702	2982	2737	2947	3.67	3.42	3.20	3.64	3.26	3.58
	Leukemias	2572	2657	2490	2823	2536	2777	3.11	2.50	2.15	2.85	2.33	2.67
	All cancers (malignant and benign)	74 270	77 146	75 471	78 821	75 908	78 384	85.08	81.81	80.25	83.36	80.73	82.89

PI, prediction interval; CI, confidence interval; std., standardized.

Table 5. Number of predicted deaths and mortality rate in Poland for the year 2011, with 95% PIs and CIs and comparison data from 2008

Sex	Cancer	Recorded deaths 2008	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2008	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	3547	3411	3192	3629	3251	3571	12.65	11.56	10.79	12.33	11.02	12.10
	Intestine (colon and rectum)	6035	6278	6042	6514	6108	6448	21.16	20.71	19.92	21.50	20.14	21.28
	Pancreas	2253	2314	2119	2510	2243	2385	8.18	8.36	7.63	9.09	8.09	8.63
	Lung	16 880	16 560	16 039	17 081	16 215	16 904	61.70	56.66	54.66	58.67	55.35	57.98
	Prostate	3892	4187	4042	4332	4086	4288	12.63	12.58	12.10	13.05	12.26	12.90
	Leukemias	1454	1555	1464	1645	1501	1608	5.46	5.31	4.89	5.73	5.09	5.52
	All cancers (malignant and benign)	53 543	54 560	53 382	55 737	53 784	55 335	192.99	183.69	179.28	188.09	180.83	186.55
Women	Stomach	2026	1829	1691	1967	1740	1918	4.60	3.93	3.59	4.28	3.73	4.14
	Intestine (colon and rectum)	5186	5120	4863	5378	4955	5286	11.50	10.79	10.14	11.43	10.31	11.27
	Pancreas	2269	2272	2105	2438	2211	2332	5.26	5.31	4.88	5.74	5.16	5.47
	Lung	5643	6343	6132	6555	6194	6493	15.53	16.60	15.96	17.24	16.16	17.05
	Breast	5362	5639	5423	5855	5485	5793	14.68	14.49	13.85	15.14	14.04	14.94
	Uterus (cervix and corpus)	3042	3055	2891	3219	2934	3176	8.55	7.95	7.46	8.45	7.59	8.32
	Leukemias	1175	1247	1162	1333	1197	1298	3.03	2.92	2.63	3.22	2.77	3.08
	All cancers (malignant and benign)	41 977	44 356	43 513	45 199	43 720	44 993	105.22	104.39	101.86	106.92	102.47	106.31

PI, prediction interval; CI, confidence interval; std., standardized.

Table 6. Number of predicted deaths and mortality rate in Spain for the year 2011, with 95% PIs and CIs and comparison data from 2005

Sex	Cancer	Recorded deaths 2005	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2005	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	3549	3226	3009	3443	3054	3398	8.68	6.77	6.21	7.34	6.29	7.26
	Intestine (colon and rectum)	7927	8816	8431	9201	8487	9145	18.43	18.00	17.30	18.69	17.40	18.59
	Pancreas	2420	2779	2644	2914	2686	2872	6.34	6.51	6.14	6.88	6.23	6.78
	Lung	16 647	18 408	17 644	19 172	17 739	19 077	43.90	42.34	40.25	44.43	40.49	44.20
	Prostate	5512	5449	5106	5792	5162	5737	10.41	8.67	8.15	9.20	8.25	9.10
	Leukemias	1718	1772	1647	1897	1676	1869	4.48	3.62	3.21	4.04	3.32	3.92
	All cancers (malignant and benign)	62 664	67 841	66 444	69 239	66 620	69 063	155.82	145.45	141.74	149.15	142.22	148.67
Women	Stomach	2132	1846	1713	1979	1751	1941	3.64	2.70	2.45	2.95	2.52	2.88
	Intestine (colon and rectum)	5913	6368	6188	6547	6229	6507	9.64	9.14	8.74	9.54	8.82	9.46
	Pancreas	2171	2380	2233	2528	2256	2504	3.81	3.68	3.39	3.96	3.43	3.92
	Lung	2471	3027	2891	3164	2926	3129	5.64	6.48	6.11	6.84	6.19	6.77
	Breast	5727	5952	5635	6270	5682	6223	12.87	11.32	10.49	12.15	10.59	12.06
	Uterus (cervix and corpus)	1863	1893	1792	1994	1836	1950	3.90	3.55	3.30	3.80	3.39	3.70
	Leukemias	1291	1319	1212	1426	1240	1398	2.62	1.83	1.50	2.16	1.61	2.04
	All cancers (malignant and benign)	37 542	39 766	38 935	40 597	39 056	40 476	71.77	65.86	63.72	67.99	63.92	67.79

PI, prediction interval; CI, confidence interval; std., standardized.

some error occurred. These predictions are based on the most recent trends in available data, i.e. up to the year 2007 (2005 for Spain, 2006 for Germany and 2008 for Poland). However, if a change, or even a reversal of trends, has taken place in the last 2 or 3 years, the joinpoint regression model is not likely to be able to pick it up. Therefore, these predictions should be

Table 7. Number of predicted deaths and mortality rate in the UK for the year 2011, with 95% PIs and CIs and comparison data from 2007

Sex	Cancer	Recorded deaths 2007	Predicted number of deaths	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)	World std. death rate 2007	Predicted world std. death rate	Lower PI (95%)	Upper PI (95%)	Lower CI (95%)	Upper CI (95%)
Men	Stomach	3277	2293	2068	2518	2180	2406	5.21	3.07	2.64	3.50	2.87	3.27
	Intestine (colon and rectum)	10 081	10 262	9888	10 636	9974	10 549	16.63	15.50	14.88	16.13	15.01	16.00
	Pancreas	3763	3825	3648	4002	3721	3929	6.62	6.41	6.10	6.72	6.21	6.60
	Lung	19 700	18 245	17 679	18 812	17 851	18 639	33.13	28.29	27.35	29.22	27.64	28.93
	Prostate	10 256	10 177	9782	10 573	9850	10 505	13.84	12.63	12.15	13.11	12.26	13.00
	Leukemias	2505	2668	2531	2806	2568	2768	4.42	4.19	3.92	4.47	4.04	4.35
	All cancers (malignant and benign)	82 998	82 090	80 741	83 439	81 139	83 041	137.97	126.37	123.98	128.77	124.76	127.99
Women	Stomach	1976	1289	1118	1461	1200	1378	2.29	1.31	1.09	1.53	1.21	1.42
	Intestine (colon and rectum)	9161	9072	8753	9390	8829	9315	10.88	10.41	9.98	10.84	10.08	10.74
	Pancreas	3996	4126	3956	4297	4013	4239	5.11	5.13	4.89	5.36	4.97	5.28
	Lung	14 900	15 632	15 145	16 119	15 290	15 974	20.57	20.33	19.69	20.96	19.90	20.76
	Breast	12 014	11 949	11 444	12 454	11 592	12 306	18.39	17.21	16.50	17.91	16.69	17.72
	Uterus (cervix and corpus)	2609	2368	2226	2510	2263	2472	4.09	3.53	3.28	3.78	3.38	3.69
	Leukemias	1867	1898	1780	2017	1846	1950	2.54	2.36	2.14	2.59	2.28	2.45
	All cancers (malignant and benign)	76 619	74 497	72 595	76 400	72 917	76 078	103.68	95.56	93.03	98.10	93.47	97.66

PI, prediction interval; CI, confidence interval; std., standardized.

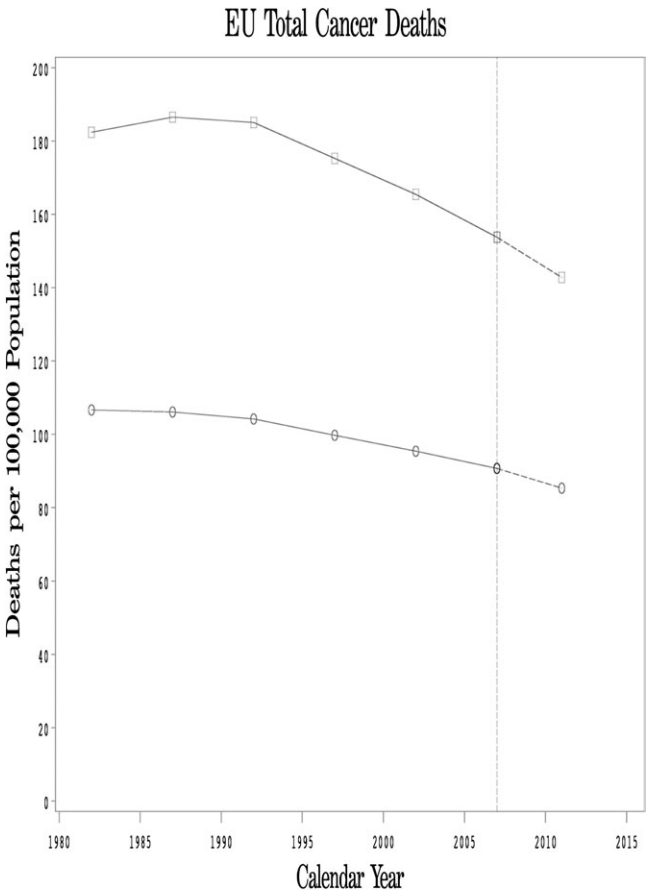

Figure 1. Age-standardized (world population) total cancer mortality trends in 5-year steps from 1982 to 2007 and the predicted rates for 2011, for men (squares) and women (circles) in the EU. EU, European Union.

interpreted as the estimated numbers of deaths and rates under the hypothesis that recent trends will continue in the near future. The issue of random variation in the estimates of recent and hence future trends must also be considered. However, we have analyzed the whole of the EU and its six major member countries that have the most stable rates. Random variation may be an issue for the younger age groups, where number of deaths is smaller. However, imprecision in these age groups has a modest effect on the overall number of cases and hence on age-standardized rates.

We published an analysis of trends in cancer mortality in Europe from the early 1980s up to 2000–2004 [1]. In commenting the present results, it is also of interest to note the evolution in rates up to the midyear for the subsequent quinquennium, i.e. 2007, in addition to the predicted rates for the year 2011.

stomach cancer

Long-standing declines in stomach cancer mortality have been observed since the 1960s, which are likely to continue in 2011, as suggested by an age-period-cohort analysis of gastric cancer mortality data in Europe [10]. In the early 1980s, in the EU, stomach cancer was the second cause of cancer death in men together with colon cancer, after lung cancer, and the third one in women, after breast and colon cancer. In 2011, stomach cancer is the fifth cause of death in men and the sixth in women. The drops will be proportionally lower in Poland, where rates are higher, compared with the EU as a whole, thus increasing the gap with lower risk countries. The decrease in rates more than compensates for the aging of the population, and the estimated absolute numbers of deaths in 2011 are also lower than in 2007 for both sexes [11].

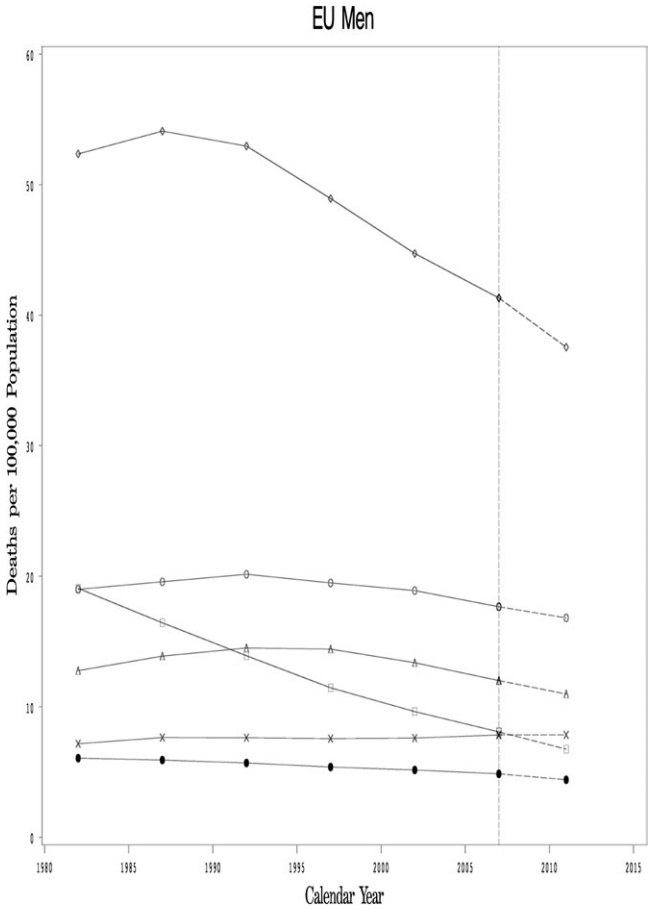

Figure 2. Age-standardized (world population) EU male cancer mortality trends in 5-year steps from 1982 to 2007 and the predicted rates for 2011: stomach (squares), intestines (circles), pancreas (crosses), lung (diamonds), prostate (triangles) and leukemias (full circles). EU, European Union.

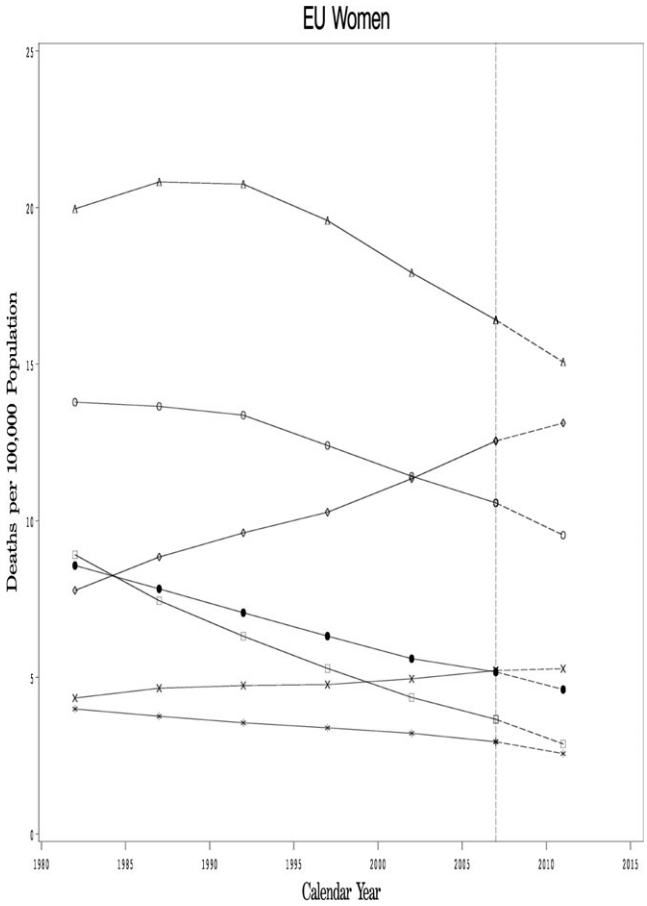

Figure 3. Age-standardized (world population) EU female cancer mortality rate trends in 5-year steps from 1982 to 2007 and the predicted rates for 2011: stomach (squares), intestines (circles), pancreas (crosses), lung (diamonds), breast (triangles), uterus (full circles) and leukemias (asterisks). EU, European Union.

colorectal cancer

The declines observed up to 2004 in colorectal cancer mortality in both sexes have continued up to 2007 and will likely carry on up to 2011. Germany shows the largest absolute and relative declines in both sexes. Again, the predicted trends are less favorable in Polish men but comparable in Polish women. This reflects the trends observed in the late 1980s and 1990s in Western Europe [1, 12] and North America [13, 14], where declines also started earlier in women than in men. This was related to earlier adoption of favorable dietary pattern and/or diagnostic and therapeutic improvements in women.

pancreatic cancer

A stabilization of rates is predicted for pancreatic cancer, with only modest changes between 2007 and 2011. Rates were approximately stable in men in earlier periods too, while a steady increase was observed in women up to 2004 [1, 15]. If true, the lack of increase in pancreatic cancer rates in women is an important favorable indicator. Given the declines in mortality in most other major cancers, pancreatic cancer is likely to become the fourth cause of cancer death in both sexes.

lung cancer

Lung cancer mortality rates will continue to decline in EU men, albeit Spain and France showed shallower declines [1]. Changes in ranking occurred among the six major European countries. While Poland maintains the highest rate, and the UK and Germany the lowest ones, Spain and France now have higher rates than Italy, where they are declining faster than in the EU as a whole. Conversely, lung cancer mortality in women has increased up to 2007 in the EU, and the upward trend is likely to continue until 2011. This is evident in all countries except the UK, where rates are approximately stable at high levels. This suggests that the lung cancer epidemic in European women is still expanding, and the rate may ultimately approach 14 to 15 per 100 000 in 2015 [16]. Already in 2007–2008, lung cancer was the first cause of cancer death in the UK and in Poland, with rates higher than those of breast cancer.

breast cancer

The model predicts continuing declines in breast cancer mortality rates, essentially due to improved management and treatment of the disease [17, 18]. The declines are relatively

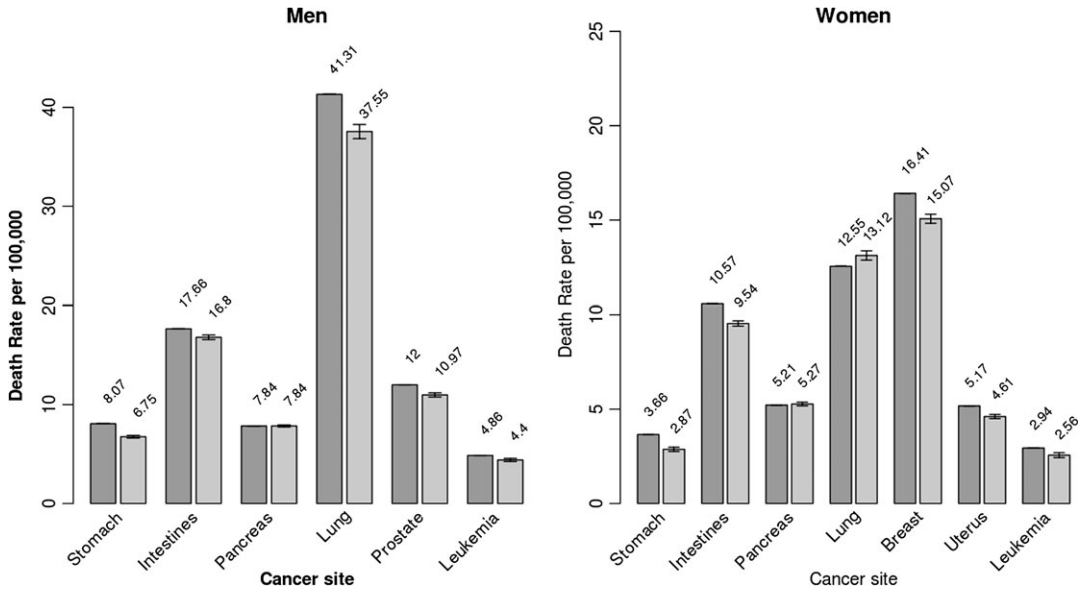

Figure 4. Bar plots of standardized death rates per 100 000 population for the year 2007 (dark gray) and the predicted rates for 2011 with 95% prediction intervals (light gray) for the EU in men and women in the studied cancer sites. EU, European Union.

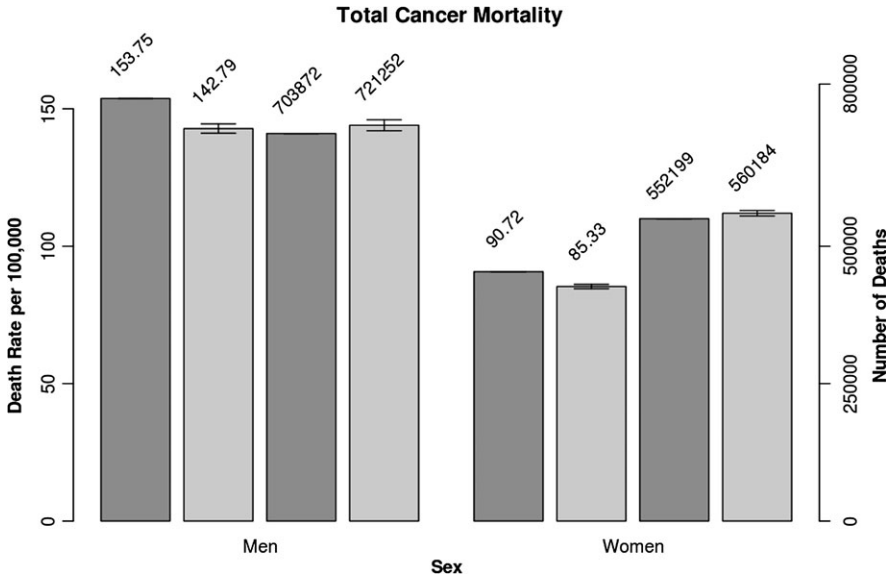

Figure 5. Bar plots of standardized death rates per 100 000 population and certified deaths for the year 2007 (dark gray) and the predicted rates and number of deaths for 2011 with 95% prediction intervals (light gray) for total cancer mortality in the EU in men and women. EU, European Union.

modest in Poland and France, as was the case in previous periods [1]. It is difficult to interpret these small differences in rate changes, but the rate in Poland was 17% lower than in the EU in 2000–2004, 11% lower in 2007 and is predicted to be only 4% lower than in the EU in 2011, reflecting a long-term tendency toward leveling of breast cancer rates in Europe, starting from rates 25% to 30% lower in Eastern than in Western Europe [19].

uterine cancer

Cancers of the cervix and corpus uteri have different etiology and descriptive epidemiology, and not being able to distinguish them in death certificates is a major drawback. However, the constant declines in uterine cancer mortality are mostly due to the effective prevention of cervical cancer through screening. The rates in Poland will remain about double than those of the other five countries considered, reflecting the delay observed in former nonmarket countries in the adoption of effective preventive strategies [20].

prostate cancer

Declines in prostate cancer mortality are expected, albeit in Poland the rates for 2008 and 2011 are stable. Declines were already observed in France, Germany and the UK between 1994

and 2004, but trends were still upward in Poland and approximately constant in Italy and Spain [1]. Thus, the data for 2007 and the predictions for 2011 suggest that the tendency toward a decrease—or at least a leveling off in Poland—in prostate cancer mortality trends will spread through the EU. This is likely attributable to improvements in diagnosis and, chiefly, treatment of the disease [14, 21, 22].

leukemias

The declines in leukemias already observed in previous periods are likely to have continued up to 2011. Up to 2004, later and smaller declines were observed in Eastern and Southern Europe [1, 14, 22]. This does not seem the case anymore for Southern Europe, represented by Italy and Spain, where more marked declines were predicted than in other countries, particularly in women. High rates and shallower declines are still foreseen in Poland.

all neoplasms

A substantial decline in total cancer mortality rates has been observed since the late 1980s in men and since even earlier in women in the EU. Between 1990–1994 and 2000–2004, the rates declined by 9% in men, to reach the value of 168.0/100 000 men, and by 8% in women, reaching the rate of 96.9/100 000 women [1]. In men, the decline has continued in 2007 and will likely carry on up to 2011, and the greatest drop is predicted in Germany. For women too, the declines persist, but the trend in Polish women is less favorable. Given that Poland has the highest total cancer mortality rates in both sexes, the lack of improvement is particularly worrying. In France, the predicted decline is also modest, although the 2011 rate in French women remains the second lowest after Spain. This is due to the recent unfavorable trends in lung cancer among French and Spanish women [23].

conclusions

Declines in mortality already observed for major sites, including stomach, colorectum, breast, uterus, prostate and leukemias, plus lung cancer in men, have likely continued up to 2011, and a reversal of trends or at least a leveling off is predicted in the few situations where upward trends were observed in the past. Thus, at least in the direction of trends, there appears to be a tendency toward greater homogeneity between the six countries considered and likely also among other EU countries. Lung cancer in women is steadily increasing (except for the UK where rates were already high a decade ago) and has become the first cause of cancer death in Polish women, in addition to women from the UK. More encouraging trends were foreseen for pancreatic cancer, which showed worrying trends in the past, as our model indicated that the increasing trends in women have likely leveled off in recent years. The present estimated rates, therefore, are in broad agreement with projections made for cancer mortality in Europe up to 2015, which estimated persistently falling rates and approximately constant absolute numbers of deaths [24]. They also confirm that, despite general favorable trends, the gap in cancer mortality between Western and former nonmarket economy countries of Central and Eastern Europe is likely to persist for the foreseeable future [25, 26].

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disclosure

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